



HOW TO MAKE AND USE A PINHOLE CAMERA

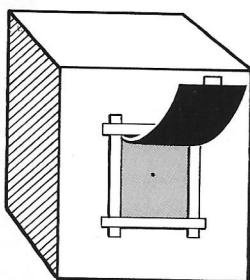
AA-5



By using common household materials, you can make a camera that will produce pictures. Making and using a pinhole camera will acquaint you with the basic elements of photography while providing an inexpensive and interesting way to take pictures. This pamphlet explains how to make and use two types of pinhole cameras—a cartridge pinhole camera and a can or box pinhole camera. You'll be proud of the pictures you can take with the camera you have constructed.

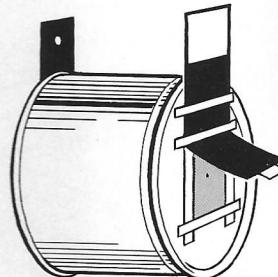
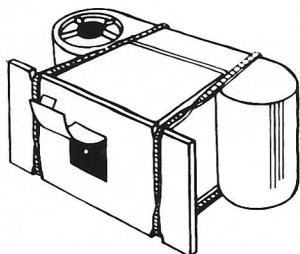
WHAT IS A PINHOLE CAMERA?

A pinhole camera is a small, lighttight can or box with a black interior and a tiny hole in the center of one end. See illustrations below. You can design it to accept roll or sheet film or a size-126 film cartridge. The two ends of the camera are parallel. The end opposite the pinhole is flat so that the film is held in a flat plane. The pinhole has a cover to prevent light from entering the camera when you aren't taking a picture.



Box pinhole camera

Can pinhole camera



Cartridge pinhole camera

CARTRIDGE PINHOLE CAMERA

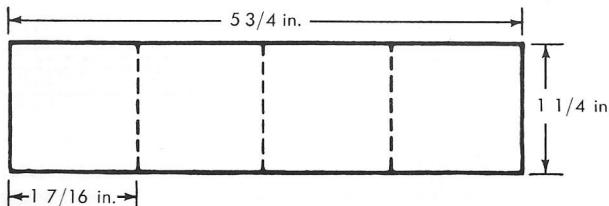
A cartridge pinhole camera is very easy to use because you can load and unload the camera in daylight, make at least 12 pictures without changing the cartridge, and have your photo dealer process the film. With a can or box pinhole camera, you must cut the film, load and unload the camera in a darkroom, reload the camera after each picture, and process the film yourself.

Materials

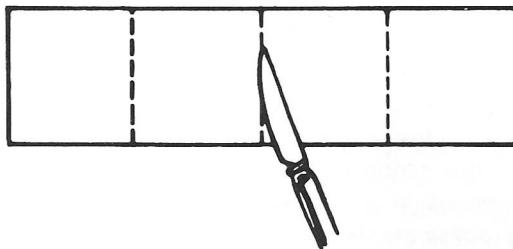
Here are the materials you will need to make a cartridge pinhole camera:

- 1 cartridge of film, size-126, such as KODAK TRI-X Pan Film or KODAK VERICHROME Pan Film for black-and-white prints or KODACOLOR II Film for color prints
- 1 piece of thin black cardboard, $1\frac{1}{4} \times 5\frac{3}{4}$ inches
- 1 piece of rigid black cardboard, $1\frac{1}{2} \times 2\frac{3}{4}$ inches, with a $\frac{1}{2}$ -inch-square opening cut in the center
- 1 piece of heavy aluminum foil, 1-inch square
- 1 piece of black paper, 1-inch square
- 2 strong rubber bands
- 1 No. 10 sewing needle
- black masking tape
- a nickel or a dime

Assembling the Camera

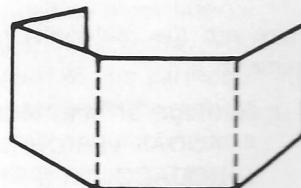


1. Measure and mark the large piece of black cardboard into four sections, each $1\frac{7}{16}$ inches wide.

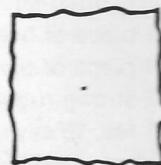


2. Using a knife, cut through only the top layer of cardboard along each of the lines. This will make it easier to fold the cardboard.

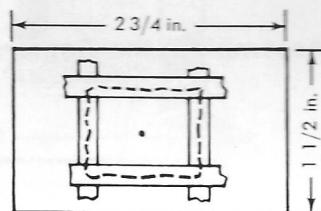
3. Fold the cardboard into a box and tape the edges together with the black tape.



4. Using only the *point* of the sewing needle, make a very tiny pinhole in the center of the aluminum foil. When you make the hole, rest the foil on a hard, flat surface.

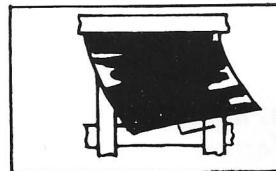


5. Center the pinhole in the foil over the square opening in the small piece of cardboard. Tape the foil to the cardboard on all four edges.

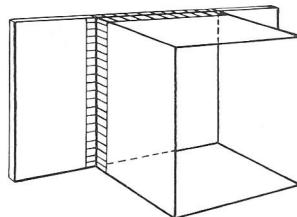


6. Put the small piece of black paper over the pinhole and tape it along the top edge. Use a small piece of tape at the bottom to hold it down between exposures.

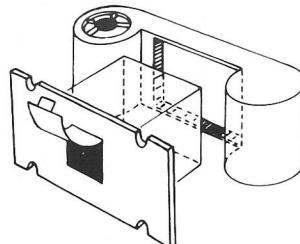
See page 6 for an alternate shutter.



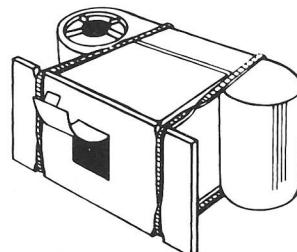
7. Tape the cardboard with the pinhole to the box. Use plenty of tape, and make sure all the edges are taped together so that no light can get into the camera box.



8. Put the camera box into the grooved recess in the square opening of the film cartridge. This should be a tight fit so that no light can get into the camera.



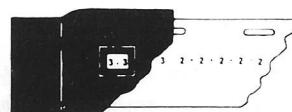
9. Use the two strong rubber bands to hold the camera in place.



10. Insert the edge of a nickel or dime in the round opening on the top of the film cartridge.

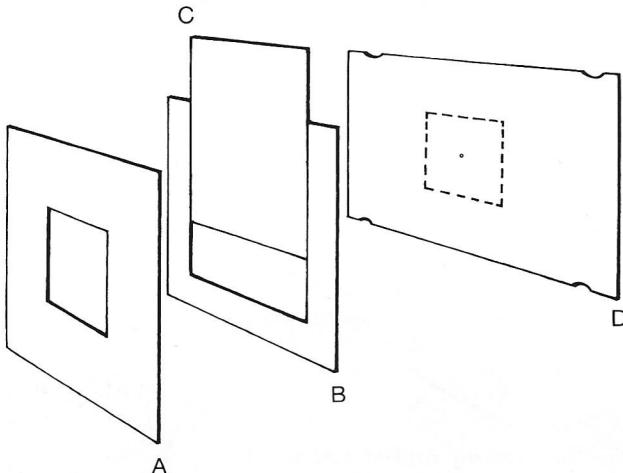


11. To advance the film in the cartridge, turn the coin *counterclockwise*. The yellow paper (visible in the small window on the label side of the film cartridge) should move. The film has borders and numbers printed on it. Turn the coin slowly until the *third and fourth* numbers in each series on the yellow paper show in the window. The film will then be in the proper position for picture-taking.



Alternate Shutter

You can make a more lighttight shutter using the diagram and instructions below.



1. Cut two $1\frac{1}{2}$ -inch-square pieces of thin black cardboard. In one piece, cut a $\frac{1}{2}$ -inch square hole in the center (A). The other piece should be cut to leave a $\frac{1}{4}$ -inch border on 3 sides (B). This is your spacer.
2. Cut a $1 \times 1\frac{1}{2}$ -inch piece of thin black cardboard (C). This is your shutter, which should easily slide into and out of the spacer (B).
3. Tape or glue parts A, B, and D together. (Part D is the $2\frac{3}{4} \times 1\frac{1}{2}$ -inch piece of cardboard cut previously to make the lens.)

Taking a Picture

Your camera must be *very still* while you are taking a picture. Try taping your camera to a table, windowsill, chair, rock, or other rigid surface. Or you can use a lump of modeling clay to mount the camera firmly on a steady support, such as a kitchen stool. Aim your camera by sighting over the top surface. A viewfinder is not essential, but if you want to make one, instructions are given on page 9.

To prevent light from entering your camera and spoiling the pictures, use the small piece of tape on the black paper to hold it down over the pinhole after each exposure. If you're using the alternate shutter, make sure the shutter is kept in the spacer between exposures.

The following table gives exposure recommendations for a cartridge pinhole camera. These recommendations are *approximate*. It's a good idea to make three different exposures for each scene to be sure you'll get a good picture. So take a picture at the recommended exposure time, one picture at twice the recommended time, and another one at one-half the time.

KODAK Film	Bright Sun	Cloudy Bright
TRI-X Pan	1/2 to 1 second	2 to 4 seconds
VERICHROME Pan	2 seconds	8 seconds
KODACOLOR II	3 seconds	12 to 15 seconds



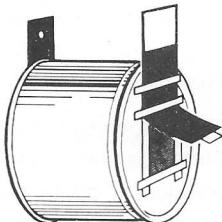
Pictures made with a cartridge pinhole camera

CAN OR BOX PINHOLE CAMERA

When you make a pinhole camera for use with film that isn't in a 126 cartridge, use a small, lighttight can or box as the camera body. You can use any can that has a *tight-fitting* top. A 2-pound coffee can

makes a good pinhole camera. You can also use a clean paint can, a vegetable shortening can, a peanut can, or even a cylindrical oatmeal box. If the can you use has a plastic lid, you can paint the lid black. Be sure to paint it inside and out; then before using it, check to make sure no paint has chipped off. Chipped or peeling paint on the lid will allow light to enter the camera and ruin your pictures.

Paint the inside of the camera body with dull black paint or line it with black paper to prevent light reflections.



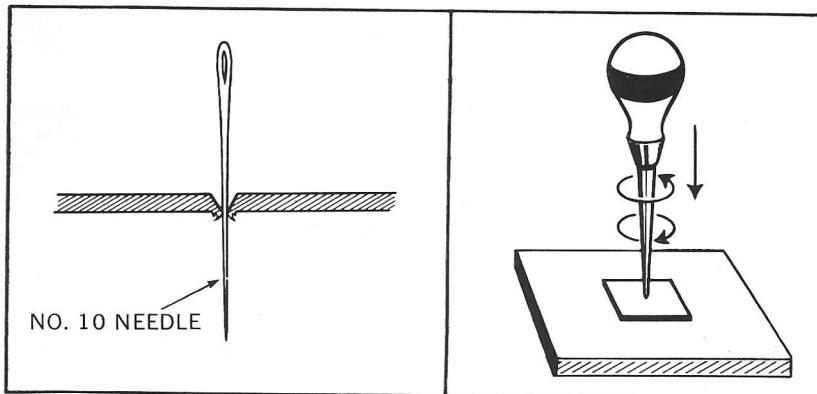
Pinhole camera made from a can

The Pinhole

With a noncartridge camera, make the pinhole in the end opposite the removable end. It's easier to attach the film to the removable end. You can make the pinhole in the box or the can itself, but it's much easier to make it in a separate piece of heavy black paper or thin metal. Then fasten this piece over a larger hole cut in the center of the permanent end of the can or box. Heavy-duty aluminum foil or the backing paper from Kodak roll film is good for this purpose.

For a camera with the pinhole 3 to 6 inches from the film, you'll get the best results if the pinhole is about 1/75 inch in diameter. You can make a hole this size by pushing a No. 10 sewing needle through the paper or metal to a point halfway up the needle shank. See left illustration on page 9. You'll get a smoother hole if you rotate the needle as you push it through. If you're using aluminum foil or paper, sandwich it between two lightweight cards while you make the pinhole. This will help you make a smoother, rounder hole.

You can also make a good pinhole in soft aluminum sheet metal. Place the aluminum on a hard surface (such as tempered hardboard). Make a small hole in the aluminum with an awl or an ice pick. Don't press too hard—the tip should just barely break through the surface. See right illustration, following. The hole will be ragged. Enlarge and smooth it by pushing a No. 10 needle into it from the indented side. You can smooth the rough edges with very fine sandpaper and then open the hole with the tip of the needle. You can use the same method to make the pinhole directly in the metal of the can by working the hole through from inside the bottom of the can.



If you make the pinhole in a separate piece of black paper or metal, you should now make a hole 1/4 inch or more in diameter in the center of one end of the camera body. Then tape your pinhole in position over the center of the hole.

You can check your pinhole to make sure it's perfectly round by looking through the back of the camera. To see if the image is clearly visible, aim the camera toward a printed page to determine if you can see the letters clearly.

The Shutter and Viewfinder

The shutter for the camera can be a flap of opaque dark paper hinged with a piece of tape. See illustration on page 4. You can use a small piece of tape to hold the shutter closed while you aren't taking a picture.

A viewfinder for a pinhole camera, while usually not necessary, can be made of cardboard or wire, as shown on page 8. The larger frame should be slightly smaller than the film size and located directly above the pinhole at the front of the camera. If the film isn't square, the viewfinder should have its longer dimension parallel to the longer dimension of the film. The small frame is a sighting peephole directly above the film and squarely behind the center of the large frame.

When you aim your camera at subjects closer than 5 feet, tip the camera up slightly to allow for parallax—the difference between the view you see through the viewfinder and the image recorded on the film. This effect is caused by the separation between the viewfinder and the pinhole.

Loading a Can or Box Pinhole Camera

You can load the camera either with film or fast photographic paper. Paper is easier to handle since you can load it into the camera under a safelight. If you don't have a safelight, you can work by the light of a flashlight covered with several thicknesses of red cellophane paper placed 6 to 8 feet away. Most film, on the other hand, must be handled in total darkness. Your choice of film or paper may depend in part on the exposure times. Paper, because it is less sensitive to light than film, will probably require an exposure of about 2 minutes for sunlit subjects. Film may require only 1 or 2 seconds for subjects in sunlight.

If you decide to use paper, try KODABROMIDE Paper F (glossy), No. 2, Single Weight. You can obtain this paper in the 4 x 5- or 5 x 7-inch size in 25-sheet packages from your photo dealer (corners may have to be trimmed to fit a cylindrical camera). If you use film, you can cut up a roll of KODAK TRI-X Pan Film, 120 size, into 2 3/8-inch squares or 2 3/8 x 3 1/2-inch pieces. This must be done in total darkness, of course. At night a closet will probably be dark enough if lights in adjoining rooms are turned off. Sheet film, such as KODAK ROYAL Pan Film 4141 (ESTAR Thick Base), is easier to use because it's flat.

A camera made from a 2-pound coffee can will take a 2 1/4 x 3 1/4-inch piece of film or photographic paper. You can use a 3 1/4 x 4 1/4-inch piece if about 1/2 inch is clipped from each corner of the film or paper. A camera made from a 1-gallon paint can will take a 4 x 5-inch piece of film or paper.

When you have the size of paper or film you need, tape it firmly to the inside of the end of your camera opposite the pinhole. The emulsion should face the pin hole. The emulsion side of photographic paper is the shiny side. The emulsion on roll film is on the inside of the curl. Sheet film is identified by notches cut into one of the shorter sides. When you hold the film in a vertical position with the notches in the top edge toward the right side, the emulsion is facing you. Another way to determine the emulsion side of either paper or film is to touch both sides with a moistened finger. The emulsion side will feel slightly tacky. Test near the edge to avoid a fingerprint in the center of the picture. You will need to tape down the four corners if you use cut-up roll film or paper. Taping two diagonal corners will work for sheet film. Close the camera, making sure the shutter is closed.

Exposure

To get clear, sharp pictures, you must keep your camera *very still* while the shutter is open. Use tape or a lump of modeling clay to hold your camera to a table, windowsill, chair, rock, or other firm support. Lift the black paper to uncover the pinhole and keep the pinhole uncovered for the recommended time. Cover the pinhole with the black paper between exposures.

The following table gives exposure recommendations for a can or box pinhole camera. These recommendations are *approximate*. It's a good idea to make three different exposures for each scene, as explained on page 7, to be sure you'll get a good picture.

KODAK Film or Paper	Bright Sun	Cloudy Bright
TRI-X Pan Film or ROYAL Pan Film 4141 (ESTAR Thick Base)	1 to 2 seconds	4 to 8 seconds
VERICHROME Pan Film	2 to 4 seconds	8 to 16 seconds
KODABROMIDE Paper, F2	2 minutes	8 minutes

Pinhole size: 1/75 inch. Film-to-pinhole distance: 4 1/2 inches. Film: KODAK ROYAL Pan 4141 (ESTAR Thick Base). Exposure: 5 minutes. Subject lighted by one No. 2 photolamp in reflector 10 feet away and aimed slightly above subject.

Note: First piano key is 4 1/2 inches from pinhole. This picture, as well as the others in this pamphlet, shows that a pinhole camera has great depth of field. Subjects close to the camera and those far away are in sharp focus.



Processing and Printing

You can process black-and-white film and paper yourself by using the KODAK Tri-Chem Pack, which includes instructions for developing photographic paper and KODAK VERICHROME Pan Film. For other films, use the chemicals recommended on the instruction sheet that comes with the film.

Print film negatives in the usual way. If you use KODABROMIDE Paper to make your picture, make the camera exposure long enough to allow the resulting paper negative to be a little darker than an ordinary photographic print. Dry the paper negative and make a contact print from it in the normal way, with the emulsion (picture) side of the paper negative toward the emulsion (shiny) side of the printing paper.

For further detailed information on processing films and papers, see Kodak publications *Basic Developing, Printing, Enlarging in Black-and-White* (AJ-2), \$3, and *Basic Developing, Printing, Enlarging in Color* (AE-13), \$3.75. If you want to learn more about picture-taking, read the 192-page Kodak handbook *How To Make Good Pictures* (AW-1), \$2.95. These publications are usually stocked and sold by photo dealers. If not available, order by title and code number directly from Eastman Kodak Company, Department 454, Rochester, New York 14650. Please send money order or check with your order, including your state and local sales taxes plus \$1 for handling. Prices shown are suggested prices only and are subject to change without notice. Actual selling prices are determined by the dealer.

MORE INFORMATION

If you have questions not answered by this pamphlet, write to Eastman Kodak Company, Photo Information, Department 841S, Rochester, New York 14650. For photo tips and ideas for pictures, see the many KODAK Photo Books for sale by your photo dealer.

Consumer Markets Division  Rochester, New York 14650

How To Make and Use a Pinhole Camera
KODAK Publication No. AA-5

Straight Reprint 4-80-DX
Printed in U.S.A.

KODAK, ESTAR, KODABROMIDE, KODACOLOR, ROYAL,
TRI-X, and VERICHROME are trademarks.